ATTACHMENT J-4

NOAA SWATH
Coastal Mapping Vessel (CMV)

PRELIMINARY DESIGN REPORT FORMAT

April 15, 2004
Revision A

United States Department of Commerce
National Oceanic and Atmospheric Administration

COASTAL MAPPING VESSEL PRELIMINARY DESIGN DATA REQUIREMENTS

The preliminary design shall be documented in a report. The purpose of the report is to describe the contractor's design and demonstrate how the requirements of the SOR will be met.

The minimum required content of each section of the report is defined in Table 1. Additional sections and appendices may be added if desired. Metric units of measurement shall be used.

Each copy of the report shall be presented in separate, loose- leaf, three ring binders. The binders shall be labeled with the Contractor's name, volume number, and the contract number.

The report shall be prepared on A-4 or 8-1/2” X 11” paper. Margins shall be at least 25 mm or 1” on all four sides. Text shall be formatted in a single column, with no more than six lines per inch, using a typeface of no more than 10 characters per inch. The use of proportional fonts in the text is prohibited. Proportional fonts may be used in the bodies of figures and tables, provided the font size is no more than 12-point. Table and figure titles and captions shall be in the same size font as the text. Foldouts may be used for figures and tables only, shall have vertical folds only, and shall not exceed the height of a single page. Foldouts shall count as one page, provided they do not exceed three folds. Each fold in a foldout that exceeds the three-fold limit shall count as one page.

The total page count for Sections 1 through 3 shall not exceed 140 pages. Section 4 will not count towards the page limitation.

Table I – Design Report Format

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4. APPENDICES

A Weight and Moment Estimate
B Endurance Fuel Calculations
C Electric Plant Load Analysis (EPLA)
D SOR Compliance Matrix

1. SHIP DESCRIPTION

1.1 Principal Ship Characteristics

A Table of Principal Ship Characteristics shall be presented in accordance with Table 2.

1.2 Margins and Allowances

Design and construction margins and service life allowances reflected in the design shall be summarized in accordance with Tables 3 and 4.

1.3 Overall Configuration

Provide general arrangement drawings, including bow and stern views, and topside configuration. The drawings shall be in accordance with SNAME T&R Bulletins 7-2 and 7-3. Antennas, navigation lights and sensors shall be shown on outboard profile. Drawing scale shall be 1:100. Level of detail and drawings shall correspond to the preliminary design phase as indicated in SNAME T&R Bulletin 7-3. Rationale and discussion of tradeoffs, where appropriate, shall be provided for key features of the general arrangement, including the locations and configurations of the following: Bridge, Charting Laboratory, multibeam echo sounding system, boat stowage and handling areas, machinery spaces, aft working deck arrangement, central control station, and ACS. Available net area shall be identified for each space and shown on a separate table. The table shall list each compartment, it's location and available net area. The bulkhead deck shall be identified. Extent of sheer and camber shall be indicated on deck plans. Provide rationale for selected values.

1.4 Hull Form and Appendages

Key features of the hull form and rationale for their selection shall be presented. A Lines plan and a Table of offsets shall be included. Principal hull form characteristics data listed in Table 5 shall be included on the body plan figure. Sketches depicting the shapes of the rudders, canards, and stabilizers shall be provided.

Table 2 - Principal Ship Characteristics

Length, OA (m)	
Length, DWL (m)	
Beam, max. (M)	
Beam, on DWL (m)	
Depth, to Main Deck Amidships (m)	
Draft, mean, Full Load (FL) at delivery (m)	
Draft, navigational, Full Load (FL) at delivery (m)	
Draft, navigational, Full Load (FL) with Service Life Allowance (m)	
Displacement, Light Ship (Mt)	
Deadweight (Loads) (Mt)	
Displacement, Full Load (FL) at delivery (Mt)	
Propulsion Plant Type	
Prime Mover (no./kW)	
Reduction Gear (type/gear ratio) (if provided)	
Propulsion power, kW/rpm @ 100% MCR	
Auxiliary propulsion (low speed ops) type, kW	
Propeller Type	
Propeller Diameter (m), Number of Blades	
Speed (knots): Free Route 80% MCR (Sustained)	
Endurance: Stores (days) Fuel (Mt) (specify governing cruise)	
Electric Plant (no./kW) (specify generator type)	
Aft Working Deck Area (sq m)	
Charting Laboratory (sq m)	

TABLE 3. DESIGN AND CONSTRUCTION MARGINS		
Margin Category	Minimum Required	Margin Allocated (percent)
Weight Design & Building Contract Modification GFM Modification Total	 Note 1 Note 2 Note 2 Note 1	
KG Design & Building Contract Modification GFM Modification Total	 Note 1 Note 2 Note 2 Note 1	
Hull Resistance, Calm Water	Note 1	
Unassigned Deck Area	Note 1	
Electric Load	Note 1	
Other (if any, specify)	Note 1	
Notes: 1. Contractor to determine 2. in accordance with the SOR.		

TABLE 4. SERVICE LIFE ALLOWANCES		
Allowance Category	Minimum Required	Allocated
Weight (% FL)	(in accordance with the SOR)	
KG Rise (FL)	(in accordance with the SOR)	
Electric Load (except deck machinery propulsion and steering)	(in accordance with the SOR)	

TABLE 5. PRINCIPAL HULL FORM CHARACTERISTICS	
Length, OA (m)	
Length, WL (m)	
Beam, maximum (m)	
Beam, at DWL (m)	
Draft to DWL, Amidships (m)	
Displacement, molded to DWL (mt)	
Max. height/width of lower hull (m)	
Max. strut width (m)	
Wet Deck clearance above DWL, amidships (M)	
Wet Deck clearance above DWL, at FP (m)	
Wetted Surface to DWL (m^2)	
Waterplane Area (m^2)	
Demihull C_B Demihull C_X, at Section of Maximum Area Demihull C_P Strut C_W	
LCB, % LWL Aft of Amidships LCF, % LWL Aft of Amidships	

1.5 Bridge Arrangements

A Bridge arrangement drawing shall be provided at 1:20 scale. The drawing shall include each control location, show locations of equipment and identify any visibility obstructions or limitations. The consoles, displays and other equipment, including overhead mounted items shall be identified. Lines-of-sight shall be shown to illustrate conformity with the SOR and CFR visibility requirements. The associated narrative shall identify any equipment dimensions that have not been confirmed and could negatively impact Bridge arrangements.

1.6 Weights and Centers

The design weight estimate shall be summarized in this section in accordance with Table 6. The load summary shall identify the heaviest load condition. VCG's shall be located in accordance with the SOR. Changes may be made to the ESWBS groups listed in the Loads Summary of Table 6 to suit the design specifics. Include a discussion of the method(s) used to prepare the weight estimate, e.g. parametrically derived from a parent ship. Identify any parent ships used for the estimate. Refer to Appendix A herein for additional detail. Discuss the sensitivity of the design to weight and center of gravity variations. Include also a description of a plan to be employed for weight control. The weight control plan shall focus on controls placed on management, engineering, purchasing, production and quality assurance organizations.

TABLE 6 WEIGHT SUMMARY – LIGHT SHIP SUMMARY					
		VERTICAL		LONGITUDINAL	
	WEIGHT (mt)	VCG (m)	MOMENT (m-mt)	LCG (m)	MOMENT (m-mt)
1 HULL STRUCTURE 2 PROPULSION PLANT 3 ELECTRIC PLAND 4 IC AND ELECTRONIC SYSTEMS 5 AUXILIARY SYSTEMS 6 OUTFIT AND FURNISHINGS 7 SMALL ARMS AND PYROTECHNICS					
TOTAL LIGHT SHIP (W/O MARGINS)					
LIGHT SHIP MARGINS					
LIGHT SHIP W/MARGINS					

TABLE 6 WEIGHT SUMMARY – (CONTINUED) LOADS SUMMARY					
		VERTICAL		LONGITUDINAL	
	WEIGHT (mt)	VCG (m)	MOMENT (m-mt)	LCG (m)	MOMENT (m-mt)
F11, F13 OFFICERS AND CREW F21 SMALL ARMS AMMUNITION F29 MISSION SYSTEMS STORES AND LOADS F31 PROVISIONS & PERSONNEL STORES F32 GENERAL STORES F41 DIESEL FUEL F46 LUBRICATION OIL F51 SEA WATER F52 FRESH WATER F54 HYDRAULIC FLUID F55 COLLECTION AND HOLDING TANKS					
TOTAL LOADS					

TABLE 6 WEIGHT SUMMARY – (CONTINUED) VARIABLE LOAD					
		VERTICAL		LONGITUDINAL	
	WEIGHT (mt)	VCG (m)	MOMENT (m-mt)	LCG (m)	MOMENT (m-mt)
LIGHT SHIP W/MARGINS					
TOTAL LOADS					
FULL LOAD					
SERVICE LIFE ALLOWANCE					
FULL LOAD WITH SERVICE LIFE ALLOWANCE					
[Modification 0002] LIGHT OPERATING LOAD					

1.7 Trim and Stability

This section shall include the ship's Curves of Form and a summary of the capacities and centers of gravity of all built-in tanks in accordance with Table 7. Include subtotals for all tanks of each particular type (for e.g., fuel, seawater ballast, etc.). Include also a summary of draft, trim, and GMT and GML in accordance with Table 8. Provide allowable KG curves for both the intact and damaged conditions, the limiting displacement for reserve buoyancy, and the following intact conditions:

a. Full load condition.
b. Full load condition with burnable fuel [Modification 0002] at 10 percent [Modification 0002] and ten percent consumables remaining.
c. Full load condition, with 50 percent fuel burned and [Modification 0002] 50 [Modificatin 0002] percent consumables onboard.

Each of the above conditions shall be met with and without the Service Life Allowance. In addition, for each of the above conditions, list the tanks and the amount of seawater ballast carried.

The allowable KG curves vs. displacement curves shall be plotted. Curves shall be shown which correspond to the governing (limiting) intact and damage stability criteria. Each curve shall be clearly labeled for the intact/damaged condition and criteria governing. Four points shall be plotted (corresponding to the ship's actual full load and burned out load conditions, at delivery and with service life allowance) with the intact and damage allowable KG curves.

Both the intact and damage stability analyses shall be clearly discussed in the report, including all assumptions. The manner in which phenomena such as free surface effects and boat launching are treated shall be clearly explained and calculated or assumed values stated. For example, the effects of launching the boat (list, trim, etc.) on ship displacement, VCG, and LCG shall be stated. The most critical stability criteria for both the intact and damage cases shall be clearly identified and described. For the worst

damage case, the damage location and extent shall be stated. If any ship operating restrictions must be imposed to meet the criteria, they shall also be described.

TABLE 7. TANKAGE SUMMARY

TANK IDENTIFICATION	MOLDED VOLUME (m^3)	USABLE CAPACITY (mt)	VCG (m)	LCG (m)	MAXIMUM FREE SURFACE (m-mt)

NOTES:
VERTICAL CENTERS FROM KEEL AMIDSHIP
LONGITUDINAL CENTERS FROM FORWARD PERPENDICULAR

TABLE 8. DRAFT, TRIM, GM_T, AND GM_L SUMMARY							
LOAD CONDITION	DISPLACE-MENT (mt)	MEAN DRAFT AMID-SHIPS (m)	TRIM (m) (+ = aft)	NAVIG. DRAFT (m)	FREE SURFACE CORR. (m)	GMT CORR. (m)	GML COR R(m)
FULL LOAD (at Delivery)							
FULL LOAD (with Service Life Allowance							
FULL LOAD WITH [Modification 0002] 10 % FUEL AND 10% CONSUMABLES (at Delivery)							
FULL LOAD WITH [Modification 0002] 10% FUEL AND 10% CONSUMABLES (with Service Life Allowance)							
FULL LOAD WITH 50% FUEL BURNED AND [Modification 0002] 50% CONSUMABLES (at Delivery)							
FULL LOAD WITH 50% FUEL BURNED AND [Modification 0002] 50% CONSUMABLES (with Service Life Allowance)							

1.8 Hydrodynamic Performance

1.8.1 Sustained Speed

Design Speed - Calculations shall be presented which clearly demonstrate that the specified Design speed is met. The speed-power calculations shall be clearly labeled and shall identify all data sources and assumptions. Hull resistance, assumed margin on predicted hull resistance, appendage resistance, hull/propeller interaction coefficients, open water propeller efficiency, mechanical losses between the prime mover and the propeller, and still air drag shall be addressed. The results of the calculations shall be discussed and key results stated, including, the predicted achievable speeds at (1) 100% MCR, (2) 80% MCR (Design speed). The required power level for towing at design speed shall be determined. In addition, free route speed - power curves shall be included. The curves shall show required propulsion power in kW and propeller rpm vs. speed in knots for the ship. The curves shall cover the range from zero to the maximum achievable speed. The data of Table 9 shall be included at the upper left hand corner of each speed-power curve figure.

TABLE 9. CHARACTERISTICS DATA

LENGTH (LWL) (m)
BEAM (B.) (M)
DRAFT (T.) (m)
DISPLACEMENT (Mt)
PRISMATIC COEFFICIENT
TRIM (m)
CORRELATION ALLOWANCE (CA)
RESISTANCE MARGIN (%)
STILL AIR DRAG INCLUDED
WETTED SURFACE (m2)
PROPELLER:
- NO. BLADES
- PROP DIAM. (m)
- PITCH (m)
- E. A. R.

TYPE OF RUDDER
TYPE OF CANARD
TYPE OF STABILIZER

Propulsors - The type of propulsors selected shall be identified. Describe and summarize all parametric calculations used to determine diameter, design RPM, pitch, blade area ratio, and number of blades. Estimates of propeller cavitation performance at the sustained and all mission profile speeds shall be provided.

1.8.2 Seakeeping

The results of seakeeping performance predictions which confirm that the seakeeping requirements of the SOR are met shall be presented. Provide a description of the seakeeping analysis tool. Document the input data; for e.g., hull form, appendage shapes, weight and center of gravity data, pitch and roll gyradii, and coordinates of points on ship at which motions are predicted. Provide rationale for any assumed values.

1.8.3 Controllability

Present the results of performance predictions which confirm that the maneuvering, stationkeeping, and precision trackline requirements are satisfied by the proposed design. Document the hull form, appendage shapes, weight and center of gravity data, and force and moment distributions for wind, current, and waves, yaw and roll gyradii, etc. assumed for the predictions. Present analyses that illustrate how the design will

satisfy the requirements. Each analysis summary shall clearly document the approach used, input data, key assumptions, and key results with discussion.

1.9 Noise and Vibration

Airborne Noise - Identify the noise sources considered and explain how airborne noise requirements were reflected in the development of the general arrangement. Perform an airborne noise analysis of at least three representative spaces, including the main machinery space and the adjacent space with the most stringent noise acceptance levels. The analysis shall be used to identify noise control measures that will result in these spaces meeting the noise acceptance levels, and to verify that the selected noise control is adequate. Identify the noise control measures adopted as a result of the preliminary assessment. Quantify allowances made for airborne noise control in the weight estimate. Results of the airborne noise analysis shall be presented.

Sonar Self-Noise – All sources of vessel self generated noise shall be considered for impact on sonar performance. Results of the sonar self-noise analysis shall be presented. The analysis shall be used to identify noise control measures that will result in the required sonar performance Identify the noise sources considered and explain how sonar self-noise requirements were reflected in the arrangement of the ship's sonar systems. Identify the noise control measures adopted as a result of this preliminary assessment. Quantify allowances made for noise control in the weight estimate.

Vibration - The method to be used for analyzing the vibration natural frequencies and forced response of the ship hull and propulsion system shall be described. Include details of how the analysis model will be developed, sources and mechanisms of vibration, and locations at which vibration will be calculated. Provide the frequency range to be considered. Describe how the results of the vibration analysis will affect the design to ensure that excessive vibration does not occur.

2. SUBSYSTEM DESCRIPTIONS

2.1 Hull Structure

Describe the overall structural configuration and provide rationale for it. Hull structure shall include identification of the hull structural material(s), framing system, scantling size, and strength deck. Provide rationale for the selected material(s) and framing system. Identify critical design loads for each transverse structural bulkhead. Identify high stress areas in primary structure. Address continuity of primary hull structure. Identify measures taken to absorb loads from docking, mooring, and boat operations. Address structural integration of the superstructure with the cross-structure and the haunch and lower hulls. Describe process to be followed to determine the long-term load exceedance distributions (fatigue). Identify the

assumed heights of tank overflows for deep tank calculations. Identify wet deck height and rationale for height selection. Present a midship section drawing, to scale, showing the structural configuration and scantlings. ABS shall have reviewed the midship section drawing and indicated concurrence on the structural arrangement and approach to structural design and development. Include appropriate notes and principal characteristics data on the drawing.

2.2 Propulsion Plant

The ship's main propulsion plants shall be described. Provide rationale for the selected plant type, configuration, rating, and shaft rpm at full power for main propulsion. Describe the propulsion plant control system and provide rationale for its selection. Describe the features incorporated in main propulsion for low speed operation if auxiliary propulsion unit is not provided. Provide rationale for the selected full power shaft rpm. Provide a scaled arrangement drawing of the propulsion and electrical generating machinery spaces, showing major items of installed equipment (plan views of each level, section view, and inboard profile). Include on the drawing major electrical and auxiliary systems equipment located in the machinery spaces and identify removal plates and location of the Centralized Control Station. Provide a shafting arrangement profile, from the prime mover to propeller. Present in Appendix B, the endurance fuel calculations for each cruise type and identify the governing cruise and the required ship fuel capacity. Include preliminary calculations used to size the shafts. Identify and provide background on selection of the Single Source Vendor (SSV) for the Integrated Diesel Electric Propulsion System (if provided).

2.3 Electric Plant

The selected electric plant, including the power distribution system and rationale for selection shall be described. Present the Electric Plant Load Analysis (EPLA) included as Appendix C to the report and identify the governing load condition for generator sizing. Document the type and capacity of the major electric plant components such as generators, main and emergency switchboards, power conversion equipment, etc. in an Electrical System One-Line Diagram. Describe and provide rationale for the electric plant control and power management system. Describe how clean and uninterruptible power will be supplied to systems or equipment onboard which may be affected by harmonic distortion from non- linear, solid state, variable speed drive power sources. Describe the proposed emergency generator and provide sizing rationale.

2.4 IC and Electronics Systems

2.4.1 Ship IC and Electronics Systems

Describe ship's navigation, interior communications, and radio communications systems. Address the Integrated Bridge System in the Navigation Section (option). Sketches depicting the arrangement of the Bridge including bridge wings and consoles shall be provided. Antennas shall be shown on the ship's topside profile.

2.4.2 Mission Electronics Systems

Describe the integration of the mission electronics systems into the vessel design. Identify the locations of all transducers.

2.5 Auxiliary Systems

A system description or schematics including identification of type and capacity for each major component, rationale for system and component selection and sizing for each of the following systems shall be provided:

2.5.1 HVAC systems
2.5.2 Fluid systems such as; bilge, ballast, firemain, firefighting, watermaking, compressed air, fuel service, seawater cooling and hydraulic systems
2.5.3 Ship control systems and canard and stabilizer actuation systems
2.5.4 Stores handling systems
2.5.5 Anchoring and mooring systems
2.5.6 Boat handling and stowage systems
2.5.7 Pollution control systems

2.6 Outfit and Furnishings

The ship facilities listed below shall be described. Address the individual spaces with respect to their locations, sizes, capabilities, and the major equipment/furnishings contained therein:

- Berthing
- Food Service (galley and mess/lounge)
- Laundry
- Damage Control
- Maintenance (workshops/workbenches/service area)
- Storerooms

2.7 Mission Systems

The following spaces and systems shall be described:

- Aft Working deck arrangements
- Service Area arrangements
- Charting Laboratory Location and Arrangement
- Multibeam Configuration
- Survey Launch Location

- Oceanographic winches
- Dive locker
- A-Frame rigging
- Crane

Identify major items of equipment, speeds, capacities and ratings. Address how and from where winches, cranes, etc. will be controlled during critical operations as well as communications and visibility between the personnel performing the operations. Include sketches to supplement the text, which show the proposed arrangements of the mission systems and the equipment listed above. The rigging sketches shall depict arrangements, system equipment, and rigging leads.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions and Recommendations

This Section may be used to recommend changes to the SOR and subsequent impacts. The submitted design, however, should not assume that the proposed recommendations will be approved.

3.2 Design to Cost Trade-Offs

Identify the level of Mission Suitability performance features provided in the preliminary design. Identify and discuss the features of the design and associated trade-offs that were fundamental in maximizing performance of this design with respect to the Mission Suitability features, SOR requirements, fuel usage with respect to distance traveled, and the NTE construction price.

3.3 Options

Summarize and discuss the option features of the provided preliminary design. Provide a tabular listing of all of the option features and the performance impact of each feature in accordance with Table 3.1. Provide supporting calculations in a separate appendix where appropriate.

3.4 SOR Compliance Summary Matrix

Summarize the compliance of the preliminary design with the selected features of the SOR in accordance with Appendix D. Identify any shortfalls of the vessel with respect to the SOR outside of the summary matrix features.

TABLE 3.1 – OPTION FEATURES AND PERFORMANCE IMPACT SUMMARY	
OPTION FEATURE	IMPACT ON PERFORMANCE OF PROPOSED OPTION
ABS 30 year design structural Fatigue Life	
Aft Control Station with throttle/steering controls	
Dynamic Positioning System (ABS DPS-0) and Lateral Trackline Error of +/- 5m	
Automated Actuation for Canard / Ship Motion Control System	
Bow Thruster Installation	
ABS Navigational Integrated Bridge and NIBS class notation	
Increased A Frame SWL at sea (increase to 4,500 kg)	
Increased Crane SWL at sea (increase to 3,000 kg)	

APPENDICES

The following appendices shall be included in the report.

APPENDIX A - Weight and Moment Estimate

An ESWBS 3-digit level light ship weight summary and load condition summaries for the various conditions shall be provided. Provide backup data and calculations as necessary to make clear the basis for the estimate in each weight category.

APPENDIX B - Endurance Fuel Calculations

Include here the endurance fuel calculations for each mission operating profile / transit range cruise. Describe the approach. State all assumptions, reference data sources, and discuss the results. Endurance fuel calculations shall be provided in accordance with SNAME Technical and Research Bulletin No. 3-49 Marine Diesel Power Plant Practices. Fuel rates shall be calculated based on the stated speeds of the ship operating at full load condition in calm water, fair weather and with a clean bottom. Identify the governing mission or transit and the required ship fuel capacity.

APPENDIX C - Electric Plant Load Analysis (EPLA)

Section 300 in the SOR defines the requirements for the EPLA. The EPLA shall be prepared and shall tabulate the data required by the Regulatory Bodies and the electrical operating load requirements for each ship operating condition. Identify whether the data is for actual equipment or derived. The load analysis shall include the mission related electrical loads for the mission equipment defined in SOR Sections 491 and 591.

The EPLA shall at least contain the following operating conditions of the ship: one generator operations, winter cruising, winter full power, winter on station at 0 speed (stationkeeping), summer on station at 0 speed (stationkeeping), summer cruising, summer full power, anchor, towing, boat launching / recovery, in-port, and emergency. If an Integrated Diesel Electric plant is provided, the EPLA shall include propulsion and propulsion motor loads. Full power shall be 100 percent of maximum continuous shaft horsepower.

Electrical loads shall be assigned at the three-digit WBS level and grouped in categories as follows:

200 Propulsion
300 Electrical
400 Electronics and Navigation

500 Auxiliary Systems
600 Outfit and Furnishings

The Electric Power Load Analysis shall show operating loads under the required ship operating conditions, tabulated and summarized in such a way as to demonstrate adequacy of the ship’s generators. The Electric Power Load Analysis shall contain data for the development of a power system with adequate generating capacity and power conditioner capacity for the loads shown.

APPENDIX D – SOR Compliance Summary Matrix

For the preliminary design provided in this report, indicate the degree of compliance with the SOR requirements listed in Table D-1

TABLE D-1 SOR COMPLIANCE MATRIX

SOR Requirement	**Does the Preliminary Design meet the SOR requirement?**
1. General Information	
Vessel Type:	
A Small Waterplane Area Twin Hull (SWATH) vessel	
Standards and Design Guidance:	
U.S. Coast Guard (USCG):	
46 CFR Subchapters U, "Oceanographic Research Vessels,"	
72 COLREGS as amended,	
International Convention on Standards of Training, Certification, and Watchkeeping for Seafarers (STCW),	
American Bureau of Shipping (ABS):	
A-1, SWATH, Oceanographic Research Vessel, unrestricted operations in the defined area of operations AMS, Circle E, ABCU, NBL	
ABS Steel vessels under 90 meters	
ABS Aluminum vessels	
ABS Guide for Design and Construction of SWATH vessels	
ABS Guide for Certification of Cranes (API Specification 2C)	
Classification: Vessel to be maintained in ABS class following delivery	
International Maritime Organization (IMO):	
Safety Of Life At Sea (SOLAS),	
International Convention for the Prevention of Pollution from Ships (MARPOL),	
MARPOL 73/78 Gulf Coast operations place this vessel in a MARPOL "Special Area"	
Bridge Design:	
ABS, Automated Bridge Control Unattended (ABCU),	
ABS, Navigational Bridge Layout (NBL),	
Ballast/trim/heel, to be operated from the bridge	
Other:	
OSHA	
U.S. Public Health Service Vessel Construction Regulations	
Clean Air Act	
Clean Water Act	
IEEE 45	
Design temperatures:	
Seawater: -2° C (28° F) to 35° C (95° F)	
Air: -18° C (0° F) to 40° C (105° F)	

SOR Requirement	Does the Preliminary Design meet the SOR requirement?
Airborne Noise:	
Manned spaces and weather deck areas: IMO Resolution A.468 (XII) "Code on noise levels on board ships; NVIC 12-82; SNAME T&R Bulletin No. 3-37, design guide for shipboard airborne noise control.	
Days-at-sea per year:	
240 days (The vessel is to be designed for year-round operation.)	
Planned lifetime in years (for ABS Fatigue Life): 20 years	
Dry Docking:	
Regular dry-docking scheduled to maintain USCG certificate of inspection and ABS Class. The docking drawing shall document the hull as delivered with all hull mounted sonars, transducers, and appendages clearly noted.	
Hull:	
The propellers and rudders shall not extend aft of the SWATH hull box structure.	
To avoid fouling of the wire and instruments, deployed over the stern, the propellers and rudders shall lie outside a 20-degree cone whose apex is at the sheave of the extended A-frame.	
The vessel shall be designed to allow small boats to come alongside safely in a seaway. Small boats will be routinely launched and recovered in support of mission objectives.	
Launch and recovery of the SOLAS rescue boat and personnel shall be as required for SOLAS certification.	
2. Dimensional Constraints	
Dimensional constraints are as follows:	
Length: Shall not be less than 26 meters overall, nor exceed 50 meters overall	
Beam: The beam shall not exceed 18.5 meters overall	
Draft: The full load draft shall not exceed 4.5 meters **(THRESHOLD)**; 3.65 meters **(OBJECTIVE)**	
Variable ballast:	
Full load draft, trim, and heel shall be maintained with in +/- 0.1 meter. Fuel burn off and other consumables shall be compensated for with variable ballast. Counter balancing for small boat, and "A" frame lifts is allowed. Ship must level out within 10 minutes of worst-case lift/launch.	
A trim/heel sensor system shall be installed on the bridge. Ballast, trim and heel shall be controlled from the bridge.	
3. Performance Requirements	
Speed, any heading:	
Design speed: 12 knots, at 80% Maximum Continuous Rating (MCR), calm water	
Transit Speed: 80% of design speed	
Trial speed: 100% MCR, 4 hours continuous	
Range at transit speed: 1,500nm range	

SOR Requirement	**Does the Preliminary Design meet the SOR requirement?**
Towing speed: 3 knots to design speed in 1.9 meters significant wave heights any heading.	
Minimum continuous speed: 1.5 knots best heading, without tow and without the use of dynamic positioning.	
Station keeping: The ability to maintain station on best heading within one vessel length in seas up to 1.8 meters significant wave height, with a wind speed up to 25 knots and a current up to 2 knots, both from the same direction.	
Precision trackline:	
An automated control steering system with the ability to maintain track at a speed, through the water, between 3 knots and design speed in any direction over the bottom, in seas up to 1.8 meters significant wave height, with a wind speed up to 25 knots and a current up to 2 knots, both from the same direction. The lateral trackline error is not to exceed +/- 10 meters	
Maneuverability:	
Maximum turning diameter at design speed in calm water, not to exceed five ship lengths. Use of differential thrust or differential canards is not allowed for this maneuver.	
Mission Profiles:	
Mission Duration - 5 days	
High Speed High Resolution Side Scan Sonar	
Multibeam Bathymetry (SWMB)	
Combination Operations (SWMB & SSS)	
An additional mission profile is an endurance transit, at transit speed.	
Fuel Capacity:	
Fuel capacity shall be based on the most demanding of the mission profile alternatives, plus a minimum reserve of 10 percent of fuel capacity.	
Stores Endurance:	
Chill/cool/dry stores: 7 days. The stores endurance shall correspond to the design crew size and design mission length for the vessel (plus 2 days).	
Motions:	
Motions shall not exceed the following, on any heading and at any speed through design speed, in seas up to 1.8 meters significant wave height. Accelerations shall be limited to 0.20g significant laterally and 0.40g significant vertically	
Maximum roll 10°	
Maximum pitch 5°	
Maximum yaw rate 3° / sec	
Maximum heave period <30 sec	
Manual control of a power actuated fixed canard with trim tab or movable canard stabilization system	
Canard design shall consider the possibility of fouling or snagging of fishing gear in the seaway.	

SOR Requirement	Does the Preliminary Design meet the SOR requirement?
Margins:	
The following margins will be available at delivery:	
Service Life Allowance: 1% of full load displacement (variable ballast compensated) at the forward end of the aft working deck	
Electric Load: 15%, ship service (at delivery not including propulsion and steering)	
Itinerant load: an itinerant load of 3,400 kgs (7,500 lbs), variable ballast compensated, to be distributed throughout the working deck and charting lab.	
4. Noise and Vibration Requirements	
Airborne noise:	
Manned spaces and manned weather deck areas must be consistent with IMO Resolution A 468 (XII) and USCG- NVIC No 12—82, SNAME T&R Bulletin No. 3-37, design guide for shipboard airborne noise control.	
Mission Acoustic:	
Vessel self-noise and radiated noise, from the hull, machinery, or propeller, must not degrade the underwater mission acoustic systems during any mission profile.	
Vibration:	
The ship and its components to be free of excessive vibration that can endanger the ship or its equipment, or interferes with the operation of any of the ship's equipment (including mission equipment) under any and all operating conditions.	
5. Working Deck Configuration and Equipment	
Configuration: The primary working deck shall be located aft. The working area adjacent to the stern A-frame shall be at least 4.6 x 5.2 meters. This does not include winch or boat footprints.	
Equipment: Sampling gear deployed by the ship will include: side scan sonar, bottom samplers, velocimeters, Conductivity, Temperature and Depth (CTD), and video-equipped Remotely Controlled Vehicles (ROV / AUV).	
Power (60 Hz 110 VAC),	
clean seawater	
fresh water,	
and ship service compressed air shall be provided to service the aft working deck.	
All activity areas shall be monitored by a pan and tilt remote controlled camera system and lit by floodlights for night operations	

SOR Requirement	Does the Preliminary Design meet the SOR requirement?
Deck equipment:	
A-frames: An A-frame, with lifting gear, shall be installed on centerline aft, of approximate clear dimensions 5.1 meters high and 3.6 meters wide, and outfitted for side scan towing, bottom sampling, deployment and retrieval of bottom-mounted sensors, ROV / AUV deployment, and velocimeter casts. The frame shall pivot on a transverse axis such that the wire can be positioned 5.1 meters inboard of the deck edge to 3.4 meters out board at a variable speed up to 20 seconds, full range, at Safe Working Load (SWL). Actuation shall be hydraulic. The A-frame shall have a SWL of 454 kg (1,000 lbs.), applied up to 30 degrees of vertical in any direction by a wire over the sheave from the winch, on any heading, in 2.5 meters (8.1 feet) significant wave heights.	
A-frame to have: Lighting,	
multi-sheave attachment points, instrumented sheaves,	
below deck sensor cable to the bridge and lab,	
sheave storage in service area,	
local and remote control from the Aft Control Station and Charting Lab,	
and exposure protection of cylinders in stored position	
Mission Winches:	
For High Speed High Resolution (HSHR) Side Scan Sonar (SSS) and CTD operations two tow winches will be GFE. A DT Marine 305 EHLWR winch (or similar) will be installed, and space and weight for an Allied System CT system winch will be provided. The winches shall be installed aft, and aligned to operate with the stern A-frame. A speed/tension/line out signal cable to be run between the winches, control stations and the bridge and lab.	
Mooring and Ground Tackle:	
The vessel shall have mooring line support for a minimum of 4 mooring lines per side, appropriately spaced along both sides.	
Capstans for line handling are required both forward and aft. Capstans forward may be independent or, part of the windlass system.	
Anchor and Windlass:	
The vessel will be operating along the coast and will require anchoring on a daily basis. An anchoring system shall be provided for anchoring from each hull.	
Crane:	
One general-purpose marine grade articulated crane installed aft to cover work areas on the after deck as well as over-the-side operations. The crane will handle sampling gear, stores, accommodation ladder, etc., at sea and pier side.	
It shall be provided with a portable remote control unit in addition to a set of fixed-deck-edge controls.	
The crane shall have a 1,360 kg (3,000 lbs) SWL capacity at a radius to lift from the A-frame launch/recovery spot, as well as, from a safe distance over the side, away from the hulls.	

SOR Requirement	Does the Preliminary Design meet the SOR requirement?
Space, weight, power reservation required for similar crane opposite side.	
After control station:	
After control station**:** Controls for the stern A-frame and aft winches shall be provided in an enclosed station with good visibility to all controlled items. Throttle controls for the ship shall be provided.	
Boats:	
One manned SOLAS rescue boat will be deployed and retrieved.	
A provision for eliminating the list/trim resulting from boat launch/recovery shall be provided.	
6. Laboratory Requirements	
Charting Laboratory:	
The Charting Laboratory shall be contiguous to the Bridge. The Charting Laboratory shall be contiguous to weather deck areas port and starboard, and shall be provided with at least one window on each side with visibility of the horizon abeam. Minimum required net area for the laboratory is 23 m^2.	
The Charting Laboratory shall be arranged with two sections. One section shall be configured as a data acquisition and processing space that shall have four GFE workstations for personal computers and monitors powered from the UPS system. The workstations shall have countertops 35 to 40 inches deep and 36 inches wide. The workstations shall have a minimum of 5 feet clearance from the front edge of the workstation to allow for personnel traffic flow. Workstations located across a walkway shall have 8 feet of clearance between the front edges of the workstations. Counter space is required for two large printers and a tape drive (84 inches total width). Floor space is required for a large plotter with approximate dimensions 60 inches wide, 30 inches deep and 60 inches high.	
One section shall be configured as a server and LAN system management area that contains the server CPUs, networking switches and several disk shelf arrays with front and back access, and a work surface for a single personal computer plus monitor. This section shall have restricted access or the equipment shall be secured in a dedicated cabinet, with the exception of the computer and monitor. If it is located in the acquisition and processing space, it shall be located away from the personnel traffic flow.	
All laboratory spaces require environmental control, including air conditioning.	
Tie downs for electronic equipment shall be provided on decks and bulkheads in a 90 cm grid (grid to suit bulkhead framing/bracing). The tie downs shall be sufficient enough to secure current electronic equipment loads.	
A unistrut type installation in the lab with 120 cm maximum spaced receptacles from UPS clean power.	

SOR Requirement	Does the Preliminary Design meet the SOR requirement?
Open and accessible wire ways for temporary cables shall be run between all mission spaces, including the charting lab, service area, and bridge. Two watertight cable pass-throughs shall be provided in the after weather bulkheads of the deckhouse, each having dimensions of 150 x 150 mm. An easily used and weather/water resistant cable pass through to the mast is required.	
Ship's Office:	
An administrative office space shall be provided and shall include a 1.4 m2 supply storage locker, two workstations, and the ship's safe, approximately 0.08 m3.	
Service Area adjacent to the aft working deck:	
There shall be storage area provided in the service area for the conventional side scan sonar, velocimeter, bottom grab sampler, dive locker and foul weather gear. Bench seating shall be provided for dressing out two divers.	
Compressed air,	
power,	
fresh	
and seawater,	
large sink,	
workbench	
and drainage will be provided.	
The gross area is 19 m^2.	
Dive Locker:	
The dive locker shall be an expanded metal cage located within the service area comprising no less than 3.7 m2.	
Additional storage for the dive tanks (12-80 cubic foot cylinders); a compressor shall be provided to charge divers air tanks as well as Self Contained Breathing Apparatus (SCBA) tanks. An air intake terminating in the space shall be provided for the compressor, supplied from an external area not affected by exhaust gases.	
Compressor shall be located and installed to minimize noise in the crew compartments.	
7. Instrumentation	
General Instrumentation (GFE) will be cross-decked or provided by a separate source. See GFI List J-7	
8. Space and Habitability Requirements	
Internal space requirements are as shown in the following. Areas have not been adjusted for partitions.	
Manning is 11 (in 6 double staterooms)	
Habitability Spaces minimum requirements	
Double stateroom - 6	
Galley	
Mess / Lounge	
Ships office	
Laundry	
Dry provisions	
Freeze/chill	

SOR Requirement	**Does the Preliminary Design meet the SOR requirement?**
Dispensary	
Mission areas	
Service area (19 m^2)	
Dive locker (3.7 m^2)	
Charting laboratory (23 m^2)	
Deck WR/WC (2)	
Operations Spaces	
Bridge	
ET shop/Data Management	
Engine rooms	
Auxiliary machinery spaces	
Steering gear and canard control rooms	
Emergency generator room	
Bosun's stores	
Engineer's stores	
General workshop	
Damage control locker (2) (3.7 m^2 each)	
Chain locker	
Paint locker	
Fan rooms	
MSD space	
Waste compactor room	
Boat gear locker (2.8 m^2)	
Small arms locker	
Additional Requirements:	
Staterooms shall have individually controlled heat and air conditioning.	
Furnishings to include berths, desks, hanging lockers, chest of drawers, sink, medicine cabinet, life jacket and survival suit stowage.	
Berths in staterooms shall be one above the other.	
A Local Area Network (LAN) shall be installed between staterooms and the ship central computer system. The charting laboratory, bridge, ships office, and general workshop shall also be connected to the above LAN. All LAN cabling and connections shall be made using fiber optics and meet gigabyte or better throughput.	
Dedicated storage to be provided for outfitting items.	
Mess service is to be cafeteria style or buffet style service.	
Bridge to be IAW, ABS-"NBL" and where required, have 360-degree visibility, open bridge wings, visibility to aft work deck.	
9. Hull, Mechanical, and Electrical	
Fresh water:	
Water making capability shall be provided. Tank capacity for 6,100 liters, and a water-making rate of 150 liters/person/day is required. Water making redundancy is required.	

SOR Requirement	**Does the Preliminary Design meet the SOR requirement?**
Automation:	
Engine room automation is required to achieve manning reductions. (ABCU)	
Propulsion System:	
If Integrated diesel electric drive configuration is provided, numbers and size of engines to provide most efficient power levels for the mix of missions. Engines of different sizes to be of the same series to provide parts commonality. No engine should run at below 65% power level to meet mission requirements. Automatic power management is required.	
All diesels shall have prelube and keep warm systems for immediate starting.	
Hull Design:	
The hull design shall be optimized for mission operations at full load draft. Consideration shall be given for safe at sea small boat operations alongside.	
HVAC:	
Heating, ventilation and air conditioning appropriate to, habitability spaces being served (65° to 75° F, 40-60% relative humidity).	
Laboratories shall maintain temperature of (65° to 75° F, 50% relative humidity), and 9-11 air changes per hour.	
Electrical power:	
Power requirements in the charting lab will be, 120/240 volt, type 1, with 20% growth.	
UPS (15 minute shutdown) shall be provided as necessary to the bridge, charting lab, and mapping lab to prevent computer data loss.	
Waste management:	
Non-food waste will be compacted and stored; space for both the compactor and interior storage of compacted trash is required. Stowing waste on the working deck is not acceptable.	
MARPOL regulations concerning the disposal of waste and wastewater within the Greater Caribbean Area must be consulted.	